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ABSTRACT

Students coming at present to technical universities are accustomed to television and the visual perception is their prime source of information. This is why our civilization is being often labeled as the "civilization of picture". The contemporary psycho-physiological researches, along with the Dale's cone of human perception, also confirm an incomparably higher level of effectiveness with the visual perception. The actual way of university teaching, however, hardly reflects these facts. This is why it often becomes boring, unattractive and ineffective, as far as the students are concerned. On the other hand, one should not overestimate the enhanced of the visual perception in the teaching process, because it also carries bottlenecks and limitation. Its overdosing could even bring negative effects. The author, after having been for 15 years a manager at the audio-visual university center, will present his life-long experience in application of the audio-visual forms of teaching at the technical universities, with all the prospects and limitations, pluses and minuses thereof. He will also deal with the economical side of the problem and with the programmed teaching. He outlines the principles of a rational and effective use of the didactic techniques in the university teaching process. (Author)

How to modernize teaching at the technical universities?

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Since time immemorial, the university teachers have endeavored to adjust their teaching to the level of their students perception and comprehension in order to achieve the best effect. The wisest teachers always tried first of all to stimulate the interest for the lectured branch of knowledge and if possible to demonstrate the lectured subject in nature (the well-known painting of Rembrandt “Doctor Tulp's anatomy lecture” of 1632, where Dr. Tulp documents the lecture on the hand physiology by dissecting the hand of an

executed criminal). The statement by John Amos Comenius, who was called also The Teacher of Nations, in his Great Didactic published in 17th century, postulated: “Let the golden rule of teachers be to present everything to the senses inasmuch as possible. The truth and certainty of teaching depends solely and exclusively on the testimony of senses.”

This perception of teaching is being confirmed by the contemporary research. Evidence for this way of assertion may be found in the work published by HAPALA (lit. 1), who suggests that the distribution of information accepted by man from his normal living environments follows the example presented on Fig. 1.

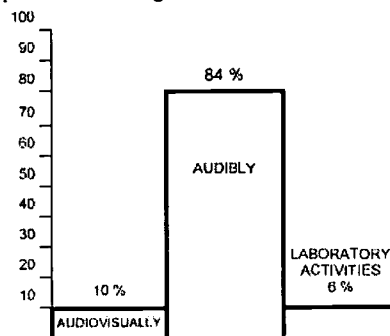


Fig 1 Perception of new knowledge in the Educational Process

However, the acceptance of new knowledge in the present traditional educational process diametrically different and, therefore, also unnatural and insufficiently efficient as apparent from Fig. 2.

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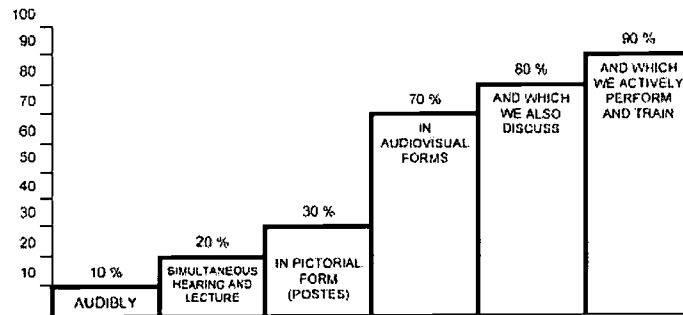


Fig 2 Percentage of remember information acquired

The state-of-art teaching technology offers a wide scope of teaching appliances ranging from slide projectors and reverse projectors to the computer-supported projection by means of the LCD panels and interactive systems of programmed teaching.

At a first glance, using these appliances brings about a considerable effect in teaching. Nevertheless, they have their limitations. Their unsuitable use can even harm the perception of students. We are quite often confronted with a sort of "crutches" whereby an inexperienced and self-conscious tutor wants to outweigh his professional deficiency by a massive use of the most modern technology. Naturally, there cannot be any positive effect achieved thereby.

Centuries-old experience instructs us that the best way of presenting new knowledge is the one where students are involved in the instruction process actively by their practical exercise and field training. After comparison of both diagrams the accentuation of the visual form of presentation of the new knowledge at all occasions where it is possible appears proper. This conclusion confirms also – among other things – the research on human memory the results of which suggest that man remembers on average after a three days period only a percentual quantity of initially presented information as illustrated on Fig. 3.

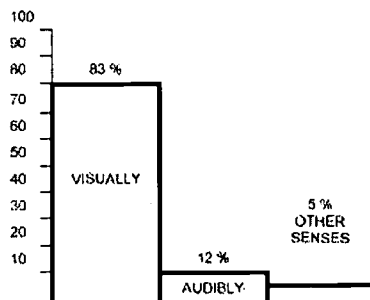


Fig 3 Acceptance of knowledge in everyday life

Therefore, the audio-visual methods of presentation of new knowledge in combination with practical activity are the most efficient ones.

Similar conclusions published also SCHNIDT [2] on the base of statistical research carried in 1980 at The University of Berlin.

The visualisation of methods of education and instruction is nowadays possible by numerous means of instruction, which can be divided into several generations according to their didactical effectiveness and capability:

- Traditional audio-visual didactical apparatus such as slide projectors, back projection apparatus, episcope, diaphone, film and video-recording. These aids can simulate the teacher only in a single function, but their capability in this single function by far exceeds the possibilities of live presentation.
- Mechanical examiners and repetitors using linear programs which can make use of the above didactical aids and multiply their efficiency by means of feedback of information on the quality and effectiveness in fulfilment of the task. The potency of these means is inferior to that of the teacher, however, concerning the presentation of the feedback of information they are superior to the teacher because they allow to use a personal control circuit for each addressee.
- Mechanical examiners and repetitors for selected programs are capable of not solely of the elementary evaluation of the performance in linear dimensions "good" or "wrong" but in comparison to the preceding type they also allow that the addressee may select the strategy in instruction in similar linear dimension "forward" or "backward".
- Electronic teaching machines for branched programs are capable – in comparison to preceding types – of explaining individually the causes of unsatisfactory performance and decide on future instructional strategy accommodated to the individuality of the addressee.
- Control panels of automated classroom which – in addition to the preceding – allow the remote control of all applied audio-visual didactic means and liberate the teacher from purely mechanical activities. As result of

this, the teacher can fully concentrate on the operative control of the instructional process.

Computers can perform all didactic functions of the preceding generations of apparatus and – contrary to the earlier generations – they are capable of an independent creation of instructional strategies according to the required target parameters of instruction and particular performance of the individual in addition to the selection of the optimum programmed instructional strategy.

However, computers can simulate not only the teacher but also the student. Therefore, they allow in optimum conditions also the tests of effectiveness of individual instructional processes.

Modernization of instructional methods

In addition to numerous instructional methods which have been made possible by the didactic potency of individual generation classes of the used didactic technology and their mutual combinations, the appearance of problem and program methods of instruction, academic and simulation games including their derivatives, PSI (Personalised System of Instruction) and other have been observed recently.

Apparently, CRUICKSHANK and MAGER [3] from the Ohio State University carried out the best categorisation up to the present of the broad scale of instructional methods, which is presented on Fig. 4. This categorisation classifies the instructional methods and distinguishes between the concrete, vicarious and abstract methods and also considers the application of concrete and model reality. It is appropriate to point out that taut this categorisation is based upon the premise of Teacher Education which, however, needsnot be fulfilled on all occasions, particularly when academic education is involved.

	Use of reality	
	REAL Reality is used	MODELED a model of reality
CONCRETE	The teacher education. Student learns the ability concretely in situ	The teacher education. Student learns the ability while he/she engages with a model of reality <ul style="list-style-type: none">♦ microteaching♦ reflective teaching♦ simulations♦ simulations games♦ teacher performance testing
VICARIOUS	The teacher education. Student learns the ability vicariously from reality or a recording of reality <ul style="list-style-type: none">♦ observing teaching♦ protocols♦ documentary films♦ case studies♦ still pictures♦ book, non-fiction♦ tape recording	
ABSTRACT	The teacher education. Student learns the ability abstractly with little or no access to or use of reality or a model of it. Emphasis is mainly or verbally communicating. The concept, skill or attitude. <ul style="list-style-type: none">♦ Words.	

Fig 4 Professional Education: Instructional alternatives whereby teaching abilities

Perhaps the most meaningful typology of this kind was elaborated more than one decade ago by Professor EDGAR DALE [4] who specified it as “A visual analogy to show the progression of learning experiences from direct, first-hand participation to pictorial representation and on to purely abstract symbolic expression”.

Didactic, methodological and dramaturgical criteria

One of the most important criteria for the evaluation of film is the criterion of their didactic and methodological value, which they present. The presentation of the film will exert

the required didactic effect on the average spectator only if its methodological and dramaturgical structure will be adequate to main syntactic and semantic film principles of the structure of didactic films. Even though that this case involves a relatively broad scale of principles which should be fulfilled from didactic, methodologic, and dramaturgical reasons, we shall present in the following at least the most important of them. The films predetermined for the instruction toward working safety at work shall:

- present the mater which cannot be adequately presented verbally or by means of statistic pictures, such as slides, episcopis projection, or back projection,
- be monothematic, because polythematic films are incomprehensible and can be understood and remembered only with difficulty,
- be cinematic and avoid static pictures and schemes,
- use comprehensive and visually legible schemes particularly diagrams,
- have captions and inscriptions of sufficient size; in this context it is generally valid that such films should avoid long text passages extending to more than one line; in case of necessity it is beneficial to use a simultaneous slide projection of the text on an adjoining screen; if text shots or slides are nevertheless applied, followings principles are valid:

- not more than five words in the title,
- not more than seven lines of the text,
- not more than seven words in a line.

Similarly, the use of tables is not recommended and it is better to replace them by graphs. If shots of tables are nevertheless applied or slides projected on an adjoining screen, they shall have:

- not more than four columns,
- not more than five to six lines,
- use animated or trick sequences to enhance the comprehensibility,
- use sober and well considered commentary which shall be neither too quick nor to long; it should cover one half to two thirds of the available time interval,
- be without accompaniment of music, particularly in theoretically more demanding films. Music does not disturb during the initial and final stages of the film – eventually – in the middle part of the film during relaxation sequences. This, however, does not apply to sound effects and real sounds which increase the authenticity ant the informative value of the film and should be applied also in the instructional film,
- have the shortest possible time of projection, fifteen minutes is the maximum; if serious reasons call for longer projection time, the film shall include relaxation sequences to draw the attention of spectators,
- contain shots of maximum informative value and avoid shots which do not contain any information even though they max be effective,

- have adequate professional treatment concerning the dramaturgy, direction, camera, cut, etc. which can either be the crown of the devaluation of otherwise valuable film.

Conclusion

Since the time of Rembrandt, the scope of available didactic appliances has widened considerably. Those available for teachers in the next century will range from the chalk up to the computer-supported interactive methods. However, even in the coming millennium, not every teacher nor every school will be able to afford money-wise and time-wise the expensive tutorial systems like e.g. that available at the University of Illinois in Urbana .

Let us therefore express the feeling that the prevailing part of tutors will have to stick to chalk and projectors (slide, reverse and video) even in the next century, with even the projectors to be used in a judicious way. Professor Baran's human perception physiology research proved that the number of slides used during one hour of lecture should not exceed 8, as the students stop to perceive any slide on top of this number. Video recordings have also their limitations – they should just complement the lecture in short sequences, not replace it. However, any university that can afford having the more expensive interactive computer-supported systems should have them, remembering that they entail – apart from the expensive technology – a yet more expensive personnel. This means additional outlays, which at the end of the day do swallow and destroy even the most prospective projects. We are not aware of any country spoiling its schools by excessive budget for the sake of expensive didactic systems.

There is, however, no need to feel sad, Ladies and Gentlemen, since it is the teacher and not the didactic aids that will predestine the level of universities in the next millennium, as well as the education level, both in the professional and in the humane respect. (J.A. Comenius requested in the 17th century already that schools become "workshops of humanness".)

We should like to document this statement by an example, with your permission. A time ago, Charles University in Prague held a seminar aimed at convincing the university teachers about the importance of didactic aids in lecturing. At the beginning, one of the professors presented the multimedia teaching using simultaneously all available means of the present-day technology. This resulted in a nice but fatiguing show of which you could remember hardly anything afterwards. Another teacher was to present the unsuitability and outdatedness of the chalk-and-blackboard supported lecture. Seminar organisers made a mistake by having chosen a retired teacher who was not only an outstanding professional, but also an experienced educationalist. He managed to introduce into the auditory which fell silent a unique atmosphere of his personality, of the contact with his listeners and of their interest in the

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lectured matter. Hence the seminar has completely misfired and proved again that it is indeed the teacher's personality that predestines the level and the efficiency of education.

Thank you for your attention.

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